II. Remarks

Claims 1 to 12 and 14 to 30 are now pending in the present application and are believed to distinguish patentably over the prior art. Claims 1, 4, 7 to 10 and 12 have been amended to define clearly the Applicants' invention. Claim 13 has been cancelled without prejudice or disclaimer. New claims 14 to 30 have been added to define further aspects of the Applicants' invention. All amendments presented herein are made for reasons of clarity with respect to the specification and drawings, and not for reasons relating to the statutory requirements for patentability.

Claims 1 to 3 have been rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,421,042 to Omura et al. ("Omura"). The Office Action alleges that the Applicants' invention as defined by these claims is clearly shown by Omura. Claim 13 has been rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Published Patent Application No. 2001/0019325 to Takekawa ("Takekawa"). The Office Action alleges that the Applicants' invention as defined by this claim is clearly shown by Takekawa. Claims 7 to 10 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Omura in view of U.S. Patent No. 6,414,671 to Gillespie et al. ("Gillespie"). The Office Action alleges that the Applicants' invention as defined by these claims would be obvious to one of ordinary skill in the art in view of the combined teachings of these references. Claim 11 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Omura in view of Gillespie and further in view of U.S. Patent No. 5,502,568 to Ogawa et al. ("Ogawa"). The Office Action alleges that the Applicants' invention as defined by this claim would be obvious to one of ordinary skill in the art in view of the combined teachings of these references. Claim 12 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Takekawa in view of U.S. Patent No. 6,531,999 to Trajkovic ("Trajkovic"). The Office Action alleges that the Applicants' invention as defined by this claim would be obvious to one of ordinary skill in the art in view of the combined teachings of these references. Applicants traverse all art rejections.

Applicants thank the Examiner for indicating allowable subject matter in claims 4 to 6. Applicants however believe claims 1 to 12 and 14 to 30 now pending in the present application distinguish patentably over the cited references for the reasons set forth below.

According to one aspect of the Applicants' invention as defined by independent claim 1, Applicants provide a method of determining the position of an object relative to a reference frame from captured images of the object based on multiple triangulation results. The captured images are taken by at least two pair of cameras having fields of view encompassing the reference frame. At least one of the cameras has an offset angle causing an extremity of the field of view of view thereof to extend beyond a boundary of the reference frame. During the method, an image of the object is captured using each camera of the at least two pair at at least one location within the reference frame. For each location, the position of the object within each captured image is determined. For each captured image, the determined position is placed into a coordinate system corresponding to that of the reference frame. The determined positions are then processed to determine the position of the object at each location and the offset angle of the at least one camera.

As will be appreciated, Applicants' invention allows the offset angle of the at least one camera to be determined. As a result, the field of view of each camera relative to the other cameras can be determined thereby allowing multiple triangulation results generated using images captured by different pairs of cameras to be aligned. If the multiple triangulation results are not aligned using the calculated offset angles, the triangulation results may vary significantly resulting in a noticeable decrease in resolution.

In contrast to the present invention, Omura discloses a co-ordinate-position inputting/detecting device including a frame encompassing a rectangular space. Provided within the frame are a lighting device at the top centre of the frame, a pair of image pickup devices at opposite top corners of the frame, and light absorbing members along the sides and bottom of the frame. When a pointer is inserted into the

rectangular space, image data captured by the image pickup devices is processed using triangulation to determine the position of the pointer.

The Office Action alleges that Omura discloses the Applicants' invention as defined by claims 1 to 3 and makes reference to the β angles disclosed by Omura. Applicants respectfully submit that the β angles disclosed by Omura are not equivalent to the offset angle as recited independent claim 1. Omura discloses a device that includes a ***single pair*** of image pickup devices to capture image data that is processed to calculate the position of a pointer using triangulation. As a result of using only one pair of image pickup devices, Omura's device yields a ***single triangulation result*** to determine the position of a pointer.

The offset angles of the Applicants' invention are calculated so that the fields of view of each camera in the touch system, which generates multiple triangulation results for a pointer contact, can be determined with respect to each other to enable the multiple triangulation results to be aligned. Omura has no need to align multiple triangulation results since only one triangulation result for a pointer contact is generated. The β angles in the Omura device are used to generate the triangulation result, and do not represent the degree by which the fields of view of the image pickup devices extend beyond the boundary of the reference frame. As is shown in the Figures of the Omura reference, the β angles of Omura extend from the peripheries of the fields of view of the image pickup devices to lines extending from the optical axes of the image pickup devices that pass through a pointer. In other words, the β angles of Omura are the same as the angles ϕ disclosed in the present application. The β angles of Omura are not processed in any manner to determine camera offset angles. This is not surprising since there is no need to do so as only one triangulation result is generated for a pointer contact.

In view of the above, Applicants respectfully submit that independent claim 1 distinguishes patentably over Omura. With respect to the remaining references cited by the Examiner, Applicants provide the following.

Gillespie discloses an object position detector with edge motion feature and jester recognition. The object position detector is of the capacitive position sensing type and includes x input and y input processing stages for sensing when pressure is applied to the surface of a touch sensing plane. The output of the x input and y input processing stages is processed to determine the position and movement of contacts on the touch sensing plane.

Ogawa discloses an optical position detecting unit configured by an image pickup unit for detecting the intensity of light. A pattern member is disposed in the front of the image pickup unit. A signal processing unit extracts information with respect to the distance in the direction of a normal line of a pixel array region of the image pickup unit between a light-emitting source and the image pickup unit on the basis of signals with respect to the specific pattern projected to the pixel array. A distance between the pattern member and the pixel array of the image pickup unit is required to be known in advance in order to extract the information with respect to the distance. By using only one image pickup unit, the distance to the light-emitting source can be calculated.

Takekawa discloses an optical coordinate input/detection device in the form of an electronic blackboard system. The device includes a pair of optical units positioned at the bottom corners of the device. The optical units emit light rays over the device and receive reflected light rays. Retroreflectors are positioned along the upper, left and rights sides of the device to reflect light impinging thereon back in the direction of impingement.

Trajkovic discloses a camera-based system including a processing system, a pair of cameras and a screen-based display. The processing system controls the cameras and the display. A user is able to interact with the system by pointing a finger towards a presentation screen of the display. During calibration, the system displays a series of icons to the user via the screen of the display. The user is directed to point to each icon and then to provide feedback to the system indicating that the user is pointing at the designated icon.

As will be appreciated neither Gillespie, Ogawa, Takekawa nor Trajkovic discloses a camera-based touch system including more than two cameras for capturing images that are processed to determine the position of a pointer using multiple triangulation results wherein the offset angles of the cameras are determined so that the triangulation results can be aligned. Ogawa, Takekawa and Trajkovic, similar to Omura disclose systems that include two or fewer cameras to capture images. Gillespie discloses a capacitive-type touch system that does not include any cameras and does not use triangulation to determine pointer contacts. As a result, these references also fail to teach or suggest determination of camera offset angles.

In view of the above, Applicants respectfully submit that the Applicants' invention as defined by independent claim 1 distinguishes patentably over the prior art and should be allowed. Since claims 2 to 6 are dependent either directly or indirectly on independent claim 1, which is deemed allowable, Applicants respectfully submit that these claims should also be allowed.

Independent claim 10 defines a method of calibrating a touch system and is similar in scope to independent claim 1. Accordingly, Applicants respectfully submit that this claim should be allowed for the same reasons set forth above. Since claims 18 to 21 are dependent either directly or indirectly on independent claim 10, which is deemed allowable, Applicants respectfully submit that these claims should also be allowed.

Independent claims 7, 9, 12, 23 and 27 define touch systems and methods wherein multiple triangulation results are generated for pointer or object determination with the multiple triangulation results being aligned by determining the offsets of the cameras or imaging devices capturing the images. As stated above, since the cited references disclose touch systems including two or fewer cameras, these touch systems do not generate multiple triangulation results nor do they determine camera offsets since this is only necessary if multiple triangulation results are generated. Accordingly, Applicants respectfully submit that these claims distinguish patentably over the cited references and should be allowed.

Since claims 8, 14 to 17, 22, 24 to 26 and 28 to 30 are dependent either directly or indirectly on one of independent claims 7, 9, 12, 23 and 27, which are deemed allowable, Applicants respectfully submit that these claims should also be allowed.

In view of the above, it is believed the application is in order for allowance and action to that end is respectfully requested.

Respectfully submitted,

James C. Haye

Attorney for Applicants
Registration No. 44,751

PATENT ADMINISTRATOR
KATTEN MUCHIN ZAVIS ROSENMAN
525 West Monroe Street
Suite 1600
Chicago, Illinois 60661-3693
Facsimile: (312) 902-1061